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GB 2324228 A

(58) Field of Search

UK CL (Edition R ) H4L LECTP LEUF

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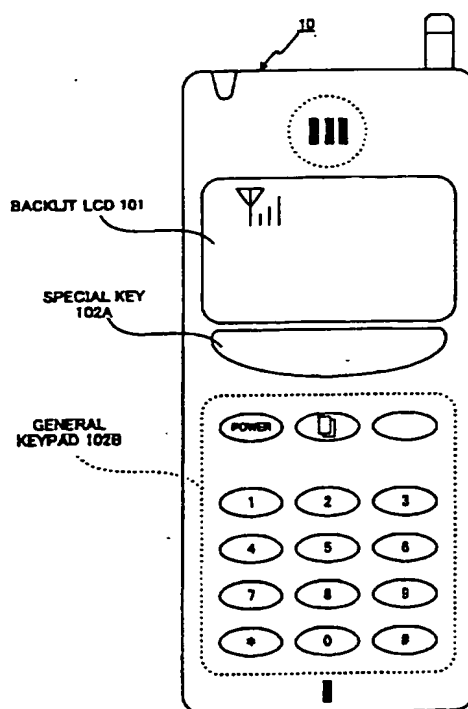
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(54) Abstract Title

**Performing a function on a radio communication device without exiting a power saving mode**

(57) A radio communication device 10 is provided with a key 102A which enables a predetermined function to be carried out without the need for exiting from a power saving mode. The function may be the display of predetermined data such as received field strength, time of day or an animated comic character. The backlight of the display is operated to coincide with the display of the data. Exiting from the power save mode operates the microprocessor and may be in response to an interrupt signal provided by operation of a general key 102B. The arrangement aims to reduce power consumption.

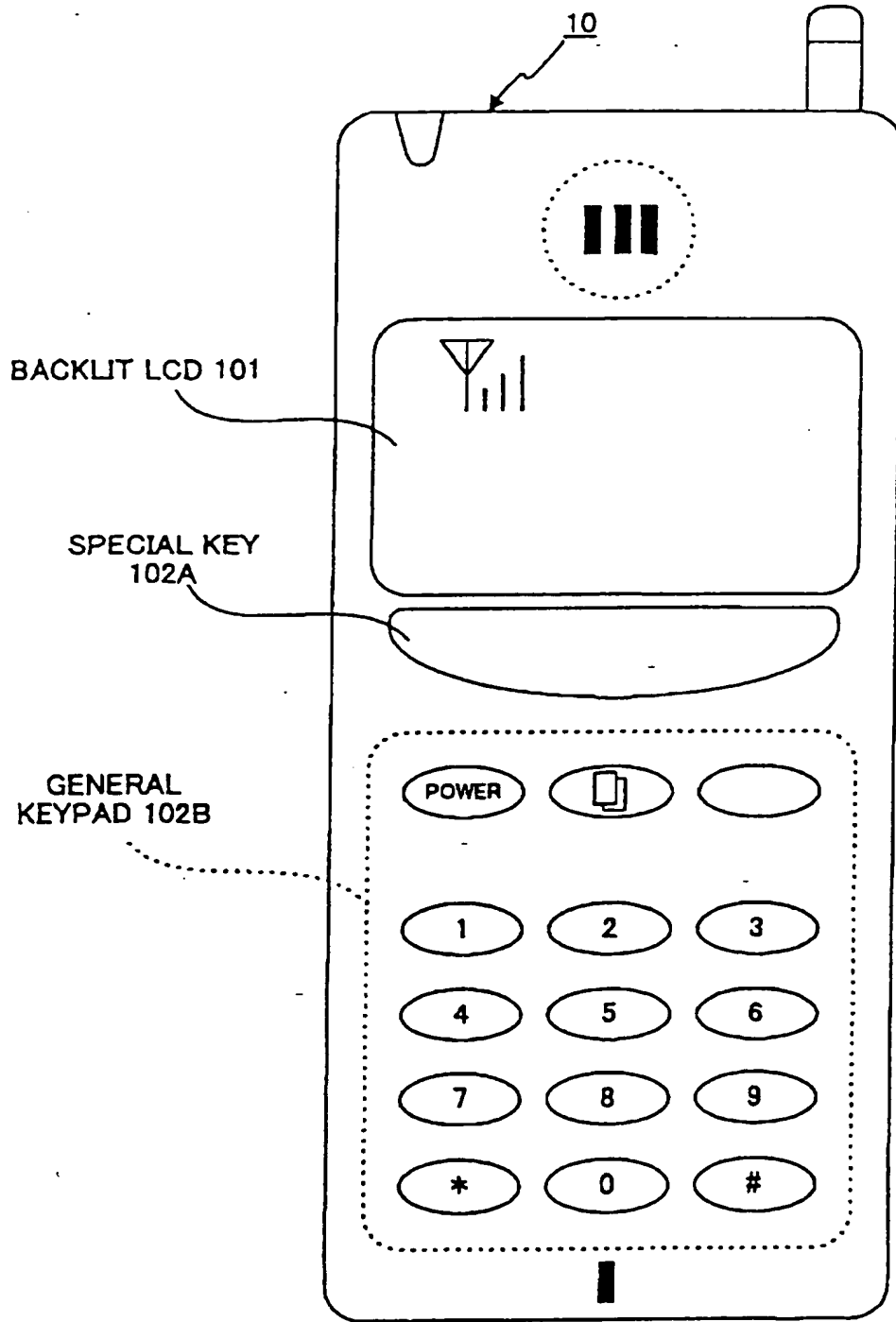
FIG. 1



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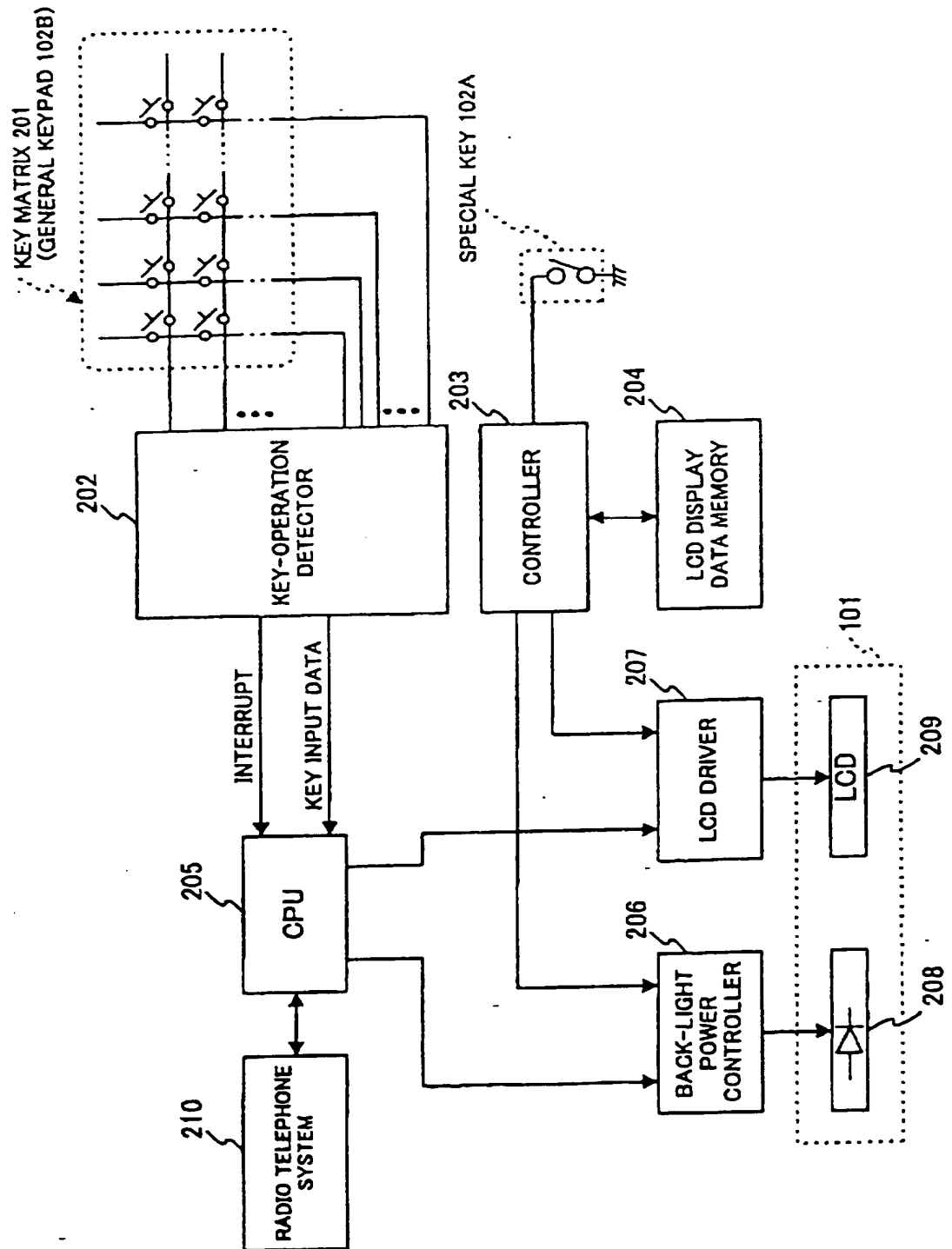
FIG. 1



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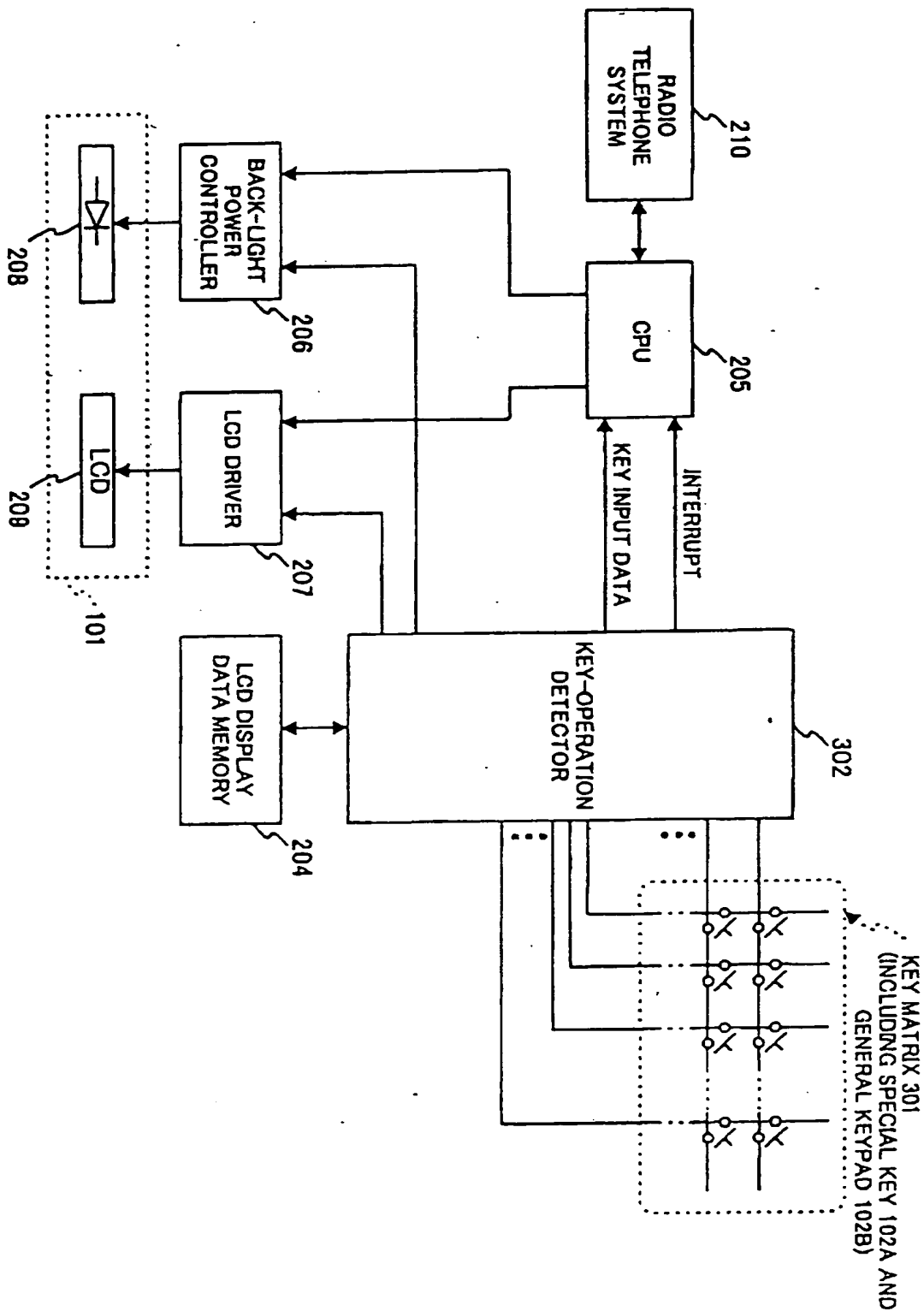
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FIG. 2



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FIG. 3



## RADIO COMMUNICATION APPARATUS AND POWER-SAVING METHOD

## BACKGROUND OF THE INVENTION

## 1. Field of the Invention

The present invention relates to a portable radio communication apparatus and, particularly, to a radio communication apparatus and a power-saving method thereof.

## 2. Description of the Prior Art

In general, portable or mobile telephones carried by users are battery-powered. Therefore, it is very important to effectively use the battery power so that the standby or continuous operation time period becomes as long as possible. Therefore, it is desirable that its power consumption be minimized.

To achieve reduction in power consumption, a portable telephone has two operation modes: a normal operation mode and a power-saving mode (which may be called HALT mode, IDOL mode, or STOP mode). When the portable telephone is not used, it operates in the power-saving mode. More specifically, a CPU of the portable telephone controls an intermittently-receiving operation to monitor the occurrence of an incoming call, and further monitors a key input through a keypad. When an incoming call occurs or any key is depressed, the operation mode is changed from the power-saving mode to the normal

operation mode. If no incoming call or no key operation occurs for more than a predetermined time period, then the operation mode returns to the power-saving mode. The time for returning to the power-saving mode varies, depending on  
5 the manufacturer of the portable radio telephone.

On the other hand, a liquid-crystal display (LCD) with backlighting has been widely used in a portable radio telephone. Such a backlit LCD improves the LCD screen's readability but draws more power than an ordinary LCD does.  
10 Therefore, reduction in power consumption is an indispensable condition especially for a battery-powered radio telephone terminal having the LCD with backlighting.

To reduce the power consumption, several power-saving methods have been proposed. For example, in Japanese Patent  
15 Unexamined Publication No. 9-27844, a portable telephone having a backlight-control function is disclosed. More specifically, the LCD is backlit when any key input or an incoming call occurs in dark conditions and, after a lapse of a predetermined time period, the backlighting is shut off.

20 Another portable terminal having backlight-control function is also disclosed in Japanese Patent Unexamined Publication No. 10-23129. In this portable terminal, an interrupt occurs and the LCD is backlit when any key input occurs at predetermined times of day. After a lapse of a  
25 predetermined time period, the backlighting is shut off. If

the key input occurs at any time other than the predetermined times of day, then the LCD is not backlighted.

However, the user does not always operate the keypad so as to make a call; rather, he may simply want to review radio conditions or learn the time of day. Recently, an increasing number of radio telephones have a function of displaying an animated comic character on screen. Therefore, the user frequently operates the keypad to see such an animated comic character. According to the prior art, as described above, such a key operation which is not intended for making a call causes the microprocessor (CPU) to change from the power-saving mode to the normal operation mode. This causes the battery power to be wasted.

#### SUMMARY OF THE INVENTION

An object of the preferred embodiments of the present invention is to provide a radio communication apparatus and a power-saving method which can achieve a reduction in power consumption.

Another object of the preferred embodiments of the present invention is to provide a radio communication apparatus and a power-saving method which can perform predetermined operations without the microprocessor changing from the power-saving mode to the normal operation mode.

According to an aspect of the present invention, a portable radio communication apparatus operable in one of a normal operation mode and a power-saving mode, comprises:

an input device having a plurality of keys consisting  
5 of a predetermined key and a plurality of general keys;

a first controller for changing an operation mode of the portable radio communication apparatus from the power-saving mode to the normal operation mode when receiving an interrupt signal; and,

10 a second controller for outputting the interrupt signal to the first controller when one of the general keys is operated and starting a predetermined operation without outputting the interrupt signal when the predetermined key is operated.

15 According to another aspect of the present invention, a portable radio communication apparatus operable in one of a normal operation mode and a power-saving mode, comprises:

a display;

a light for backlighting at least the display;

20 an input device having a plurality of keys consisting of a predetermined key and a plurality of general keys;

a first controller for changing an operation mode of the portable radio communication apparatus from the power-saving mode to the normal operation mode when receiving  
25 an interrupt signal; and,



a second controller for outputting the interrupt signal to the first controller when one of the general keys is operated and, when the predetermined key is operated, controlling the display and the light without outputting the interrupt signal such that the light backlights the display and predetermined information is displayed on the display.

The predetermined information may be at least one of the time of day, an electric field strength of a radio receiving signal, and an animated comic character.

10       The second controller may control the light such that the light backlights the display during an interval that the predetermined key is operated. The second controller may control the light such that the light backlights the display until after a lapse of a predetermined time period from a time  
15       when the predetermined key is operated.

The portable radio communication apparatus may comprise a memory storing a plurality of items of information each corresponding to a different predetermined operation. The predetermined information is a selected one of the items  
20       of information. The predetermined information is preferably a selected one of the time of day, an electric field strength of a radio receiving signal, and an animated comic character.

The predetermined key is preferably separated from a key matrix mounted with the general keys such that the  
25       predetermined key is provided near the display. The plurality of keys may be integrated on a single key matrix.

The plurality of keys may include a function key which is used to switch the second controller between active and inactive.

The input device and the second controller may be  
5 integrated to form a key input controller for outputting the interrupt signal to the first controller when one of the general keys is operated and, when the predetermined key is operated, controlling the display and the light without outputting the interrupt signal such that the light  
10 backlights the display and predetermined information is displayed on the display.

As described above, according to the present invention, when the predetermined key is depressed in the power-saving mode, the displaying and backlighting operations can be  
15 performed by the second controller while the first controller is in the power-saving mode. Therefore, the power consumption can be dramatically reduced.

Further, according to the present invention, the display processing of the predetermined information can be  
20 also performed by the second controller while the first controller operates in the normal operation mode. Therefore, some of the display processing load is taken off the first controller, resulting in improved processing speed of the first controller.

25 Furthermore, in the case of the memory storing necessary data for a plurality of predetermined operations,

a selected one of the predetermined operations can be performed independently of the normal operations while the first controller operates in the power-saving mode.

#### BRIEF DESCRIPTION OF THE DRAWINGS

5 Preferred features of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:-

FIG. 1 is a plan view showing a portable radio communication apparatus implementing a power-saving method according  
10 to the present invention;

FIG. 2 is a block diagram showing an internal circuit configuration of a portable radio communication apparatus according to a first embodiment of the present invention; and,

FIG. 3 is a block diagram showing an internal circuit  
15 configuration of a portable radio communication apparatus according to a second embodiment of the present invention.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1, a portable radio communication terminal 10, such as a mobile telephone having a power-saving  
20 function according to the present invention, is provided with a backlit liquid-crystal display (LCD) 101, a special key 102A,

and a general keypad 102B. The special key 102A is provided at a position adjacent to the LCD 101. According to the present invention, as described later, when a user depresses the special key 102A, the LCD 101 is backlighted and  
5 predetermined information such as the present time of day or the present electric field strength (radio condition) is displayed on the LCD 101. Therefore, it is preferable that the special key 102A is provided near the LCD 101. The general keypad 102B is a well-known keypad, including a ten-key pad  
10 for dialing or other operations.

Referring to Fig. 2, a key matrix 201 which is provided under the general keypad 102B is connected to a key-operation detector 202. The key switches of the key matrix 201 are scanned by the key-operation detector 202 so as to determine  
15 which key is depressed.

The telephone terminal 10 is further provided with a controller 203 connected to an LCD display data memory 204 and a key switch of the special key 102A. The key-operation detector 202 is connected to a microprocessor (CPU) 205. When  
20 any key of the general keypad 102B is depressed, the key-operation detector 202 outputs an interrupt signal to the CPU 205 and then outputs the key input data corresponding to the depressed key to the CPU 205.

The CPU 205 controls a back-light power controller 206  
25 and an LCD driver 207 which are connected to a light-emitting diode (LED) unit 208 and an LCD 209, respectively. The LCD

209 is designed to be backlighted by the LED unit 208 to form the backlit LCD 101. The CPU 205 is connected to a well-known radio telephone system 210.

The CPU 205, when receiving the interrupt signal from the key-operation detector 202, determines whether the present operation mode is the normal operation mode or the power-saving mode. When in the power-saving mode, the CPU 205 changes into the normal operation mode and controls the back-light power controller 206 to backlight the LCD 209 and then starts the normal operation depending on the key input data. That is, necessary information depending on the key input data is displayed on the LCD 209. When in the normal operation mode, the CPU 205 performs the normal operation depending on the key input data. In addition to the key input monitoring, the CPU 205 also monitors an incoming call at regular intervals. If an incoming call occurs in the power-saving mode, then the CPU 205 changes into the normal operation mode.

The controller 203 determines whether the special key 102A is depressed. When detecting that the special key 102A is depressed, the controller 203 uses predetermined display data stored in the LCD display data memory 204 to control the back-light power controller 206 and the LCD driver 207. More specifically, the LCD 101 is backlighted and predetermined information such as the present time of day or the present electric field strength is displayed on the LCD 101. The

controller 203 may use a clock/calendar circuit (not shown) built into the telephone terminal 10. The predetermined information displayed on the LCD 101 may be selected from the present time of day, the present electric field strength, an animated comic character and the like which are stored in the LCD display data memory 204.

In this manner, in the case where the special key 102A is depressed, the controller 203 does not output an interrupt signal and controls the back-light power controller 206 to supply power to the LED unit 208 and outputs the desired display data to the LCD driver 207. Therefore, the LED unit 208 is powered on without the CPU 205 changing into the normal operation mode, and the desired information (which may be a selected one as described above) is displayed on the backlighted LCD 101. In other words, the LCD 209 is backlighted by the LED unit 208 and the predetermined information is displayed thereon while the CPU 205 operating in the power-saving mode.

Another backlighting method may be employed. For example, the LCD 209 is backlighted by the LED unit 208 only during depressing the special key 102A. Alternatively, the LCD 209 may be backlighted by the LED unit 208 until a predetermined time period has elapsed from the push of the special key 102A.

A second embodiment of the present invention will be described with reference to Fig. 3, where circuit blocks

similar to those previously described with reference to Fig. 2 are denoted by the same reference numerals and the details thereof are omitted.

Referring to Fig. 3, a portable radio telephone 10 according to the second embodiment is provided with a key matrix 301 which is connected to a key-operation controller 302. The key switches of the key matrix 301 are scanned by the key-operation controller 302 so as to determine which key is depressed. The key-operation controller 302 is connected to the LCD display data memory 204 and the CPU 205.

One of the key switches of the key matrix 301 is predetermined as the special key 102A, and the other key switches as the keys of the general keypad 102B. As in the case of the first embodiment, when detecting that the special key 102A is depressed, the key-operation controller 302 uses predetermined display data stored in the LCD display data memory 204 to control the back-light power controller 206 and the LCD driver 207. More specifically, the LCD 101 is backlighted and predetermined information such as the present time of day or the present electric field strength is displayed on the LCD 101. When detecting that any key of the general keypad 102B is depressed, the key-operation controller 302 outputs an interrupt signal to the CPU 205 and then outputs the key input data corresponding to the depressed key to the CPU 205.

The power-saving backlight function according to the second embodiment may switch selectively between active and inactive. Such active/inactive selection can be implemented as a function included in a man-machine interface (MMI). In the case where the power-saving backlight function is in the active state, a push of a numeric key, for example the "1" key, causes the key-operation controller 302 to use the predetermined display data stored in the LCD display data memory 204 to control the back-light power controller 206 and the LCD driver 207 with the CPU 205 operating in the power-saving mode.

As another example, when the special key 102A has been pushed, only the information displaying area of the LCD 209 is backlighted. When any of the general keypad 102B has been depressed, both the LCD 209 and the keypad 102B are backlighted.

As described above, according to the present invention, when the special key 102A is depressed in the power-saving mode such as the standby mode, the LCD displaying and the backlighting operations can be performed by the controller 202 or the key-operation controller 302 while the CPU 205 is in the power-saving mode. Therefore, the power consumption can be dramatically reduced.

In contrast, according to the prior art, even in the case where the user intends to backlight the LCD, the CPU is changed from the power-saving mode to the normal operation



mode, resulting in increased power consumption. In general, the power consumption of the normal operation mode is one hundred to thousand times larger than that of the power-saving mode. Therefore, a very large amount of battery power is  
5 wasted only for the purpose of backlighting the LCD. The portable radio communication apparatus according to the present invention can eliminate such wasted power consumption.

Further, according to the present invention, the display processing of the predetermined information can be also  
10 performed by the controller 203 while the CPU operates in the normal operation mode. Therefore, some of the display processing load is taken off the CPU 205, resulting in improved processing speed of the CPU 205.

Furthermore, in the case of the LCD display data memory  
15 204 storing necessary data for a plurality of predetermined operations, a selected one of the predetermined operations can be performed independently of the normal operations while the CPU 205 operates in the power-saving mode.

While the present invention has been described in its  
20 preferred embodiments, it is to be understood that the words which have been used are words of description rather than limitation, and that changes may be made to the invention without departing from its scope as defined by the appended claims.

Each feature disclosed in this specification (which term includes the claims) and/or shown in the drawings may be incorporated in the invention independently of other disclosed and/or illustrated features.

5           The text of the abstract filed herewith is repeated here as part of the specification.

          A portable radio communication apparatus allows reduction in power consumption. An input device has a special key and a plurality of general keys. A microprocessor changes  
10   an operation mode from a power-saving mode to a normal operation mode when receiving an interrupt signal. A controller connected to the special key outputs the interrupt signal to the microprocessor when one of the general keys is operated. When the special key is operated, the controller controls a  
15   backlit LCD without outputting the interrupt signal such that the LCD is backlighted and predetermined information is displayed on the LCD.

## CLAIMS:

1. A portable radio communication apparatus operable in one of a normal operation mode and a power-saving mode, comprising:

input means having a plurality of keys consisting of a predetermined key and a plurality of general keys;

first means for changing an operation mode of the portable radio communication apparatus from the power-saving mode to the normal operation mode upon receiving an interrupt signal; and,

second means for outputting the interrupt signal to the first means when one of the general keys is operated, and for starting a predetermined operation without outputting the interrupt signal when the predetermined key is operated.

2. The portable radio communication apparatus according to claim 1, and also comprising:

a display; and,

a light for backlighting at least the display;

wherein the first means is a first controller and the second means is a second controller, and wherein the predetermined operation is controlling the display and the light such that the light backlights the display and predetermined information is displayed on the display.

3. The portable radio communication apparatus according to claim 2, wherein the predetermined information is at least one of the time of day, an electric field strength of a radio receiving signal, and an animated comic character.

4. The portable radio communication apparatus according to claim 2 or 3, wherein the second controller controls the light such that the light backlights the display during an interval that the predetermined key is operated.

5. The portable radio communication apparatus according to claim 2 or 3, wherein the second controller controls the light such that the light backlights the display until after a lapse of a predetermined time period from a time when the predetermined key is operated.

6. The portable radio communication apparatus according to claim 2 or 3, wherein the light backlights the display and each of the predetermined key and the keys.

7. The portable radio communication apparatus according to claim 2 or 3, further comprising a memory storing a plurality of items of information each corresponding to a different predetermined operation; wherein the predetermined operation is a selected one of the

items of information.

8. The portable radio communication apparatus according to any one of claims 2 to 7, wherein the predetermined key is separated from a key matrix mounted with the general keys such that the predetermined key is provided near the display.

9. The portable radio communication apparatus according to any one of claims 2 to 7, wherein the plurality of keys are integrated on a single key matrix.

10. The portable radio communication apparatus according to any one of claims 2 to 7, wherein the plurality of keys includes a function key which is used to switch the second controller between active and inactive.

11. The portable radio communication apparatus according to any one of claims 2 to 7, wherein the input device and the second controller are combined into a key input controller.

12. A power-saving method in a portable radio communication apparatus operable in one of a normal operation mode and a power-saving mode, the portable radio communication

apparatus comprising a microprocessor and an input device having a plurality of keys consisting of a predetermined key and a plurality of general keys, comprising the steps of:

outputting an interrupt signal to the microprocessor when one of the general keys is operated; and,

starting a predetermined operation without outputting the interrupt signal when the predetermined key is operated;

wherein the microprocessor changes an operation mode of the portable radio communication apparatus from the power-saving mode to the normal operation mode upon receiving the interrupt signal.

13. The power-saving method according to claim 12, wherein the apparatus also comprises a display and a light for backlighting at least the display, and wherein the step of starting a predetermined operation comprises the steps of backlighting the display and displaying predetermined information on the display.

14. A portable radio communication apparatus substantially as herein described with reference to and as shown in the accompanying drawings.

15. A power-saving method in a portable radio communi-

cation apparatus, the method being substantially as herein described with reference to and as shown in the accompanying drawings.



Application No: GB 0002420.8  
Claims searched: 1 to 14

Examiner: Glyn Hughes  
Date of search: 27 July 2000

## Patents Act 1977 Search Report under Section 17

### Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.R): H4L (LECTP, LEUF)

Int Cl (Ed.7): H04Q 7/32, H04M 1/73

Other: Online: WPI, JAPIO, EPODOC

### Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	GB 2324228 A (NEC) see whole document	-

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
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